What is claimed is:

1. A filtering method for use in decoding a digital signal from a frequency domain to a time domain, comprising:

a first step of multiplying an input data stream and a transformation matrix that is decomposed into a sparse matrix from an inverse MDCT transformation matrix for making the inverse MDCT transformation of said input data stream composed of a plurality of data blocks, and has a smaller size than said inverse MDCT transformation matrix, to acquire an output data stream composed of a plurality of data blocks;

a second step of storing predetermined data contained in each data block of said output data stream; and

a third step of generating the digital signal in the time domain on the basis of each data block acquired at the first step and the predetermined data stored at the second step in processing the data block at the former stage.

2. The filtering method according to claim 1, wherein

said first step further comprises a fourth step of making the DCT (Discrete Cosine Transform)-IV transformation process for each data block of the input data stream; and

said second step further comprises a fifth step of storing a part of the processed result of each data block at said fourth step that is used in processing the data block at the latter stage, and

said third step further comprises:

a sixth step of folding back and expanding a part of the processed result of each data block at the fourth step other than stored at the fifth step and multiplying the expanded data by a predetermined window to acquire a first processed result, and folding back and expanding a part of the data block at the former stage that is stored at the fifth step and multiplying the expanded data by a predetermined window to acquire a second processed result, and

a seventh step of adding the first and second processed results acquired at the sixth step.

3. The filtering method according to claim 1 or 2, wherein at the third step, the processing method for generating the digital signal in the time domain is switched on the basis of the side information including the information regarding the decoding of the data block.

4. The filtering method according to claim 2, wherein at the sixth step, the window by which each data block is multiplied is switched on the basis of the side information including the information regarding the decoding of the data block.

5. The filtering method according to any one of claims 1 to 4, wherein at the first step, the output data stream is acquired by making the matrixing on each data block of the input data stream in accordance with the following expression,

$$y = C_N^{IV} x$$

where x is a column vector of one data block contained in the input data stream, y is a column vector of output data block corresponding to x, and $C^{IV}{}_N$ is a DCT-IV transformation matrix represented by the following expression,

$$\left[C_N^{IV}\right]_{m,n} = \cos\left[\frac{\left(m+\frac{1}{2}\right)\left(n+\frac{1}{2}\right)\pi}{N}\right], 0 \le m, n \le N-1$$

where N is the number of data contained in x.

6. A filtering method for use in decoding a digital signal from the frequency domain to the time domain, comprising:

a first step of multiplying an input data stream and a transformation matrix that is decomposed into a sparse matrix from a sub-band synthesis transformation matrix for making the sub-band synthesis of said input data stream composed of a plurality of data blocks and has a smaller size than said sub-band synthesis transformation matrix to acquire an output data stream composed of a plurality of data blocks;

a second step of shifting each data block of said output data stream calculated and stored beforehand by one data block, every time each data block of said output data stream is calculated;

a third step of storing said calculated data block; and

a fourth step of generating the digital signal in the time domain on the basis of the stored data.

7. The filtering method according to claim 6, wherein

said first step further comprises a fifth step of making the DCT (Discrete Cosine Transform)-II transformation process for each data block of the input data stream;

said fourth step further comprises:

a sixth step of folding back and expanding the predetermined data of the stored data block and multiplying the expanded data by a predetermined window to acquire a data stream composed of a plurality of data blocks; and

a seventh step of adding the data contained in the data stream calculated at the sixth step at a predetermined period.

8. The filtering method according to claim 6 or 7, wherein at the first step, the output data stream is acquired by making the matrixing on each data block of the input data stream in accordance with the following expression,

$$y = C_N^{II} x$$

where x is a column vector of one data block contained in the input data stream, y is a column vector of output data block corresponding to x, and C^{II}_N is a DCT-II transformation matrix represented by the following expression,

$$\left[C_N^{II}\right]_{m,n} = \cos\left[\frac{m(2n+1)\pi}{2N}\right], 0 \le m, n \le N-1$$

where N is the number of data contained in x.

9. A filtering apparatus for decoding a digital signal from the frequency domain to the time domain, comprising:

transformation means for multiplying an input data stream and a transformation matrix that is decomposed into a sparse matrix from an inverse MDCT transformation matrix for making the inverse MDCT (Modified Discrete Cosine Transform) of said input data stream composed of a plurality of data blocks, and has a smaller size than said inverse MDCT transformation matrix, to acquire an output data stream composed of a plurality of data blocks;

memory means for storing predetermined data contained in each data block of said output data stream; and

digital signal output means for outputting the digital signal in the time domain on the basis of each data block contained in said output data stream and the data of data block at the former stage stored in said memory means.

10. The filtering apparatus according to claim 9, wherein

said transformation means makes the DCT (Discrete Cosine Transform)-IV transformation process for each data block of the input data stream;

said memory means stores a part of the processed result of each data block through said DCT-IV transformation process that is used in processing the data block at the latter stage; and

said digital signal output means further comprises:

multiplication means for folding back and expanding a part of the processed result of each data block processed through said DCT-IV transformation process other than stored

in said memory means and multiplying the expanded data by a predetermined window to output a first processed result, and folding back and expanding a part of the data block at the former stage that is stored in said memory means and multiplying the expanded data by a predetermined window to output a second processed result; and

addition means for adding the first and second processed results output by said multiplication means.

11. The filtering apparatus according to claim 9 or 10, wherein said digital signal output means switches the processing method for generating the digital signal in the time domain on the basis of the side information including the information regarding the decoding of the data block.

12. The filtering apparatus according to claim 10, wherein said multiplication means switches the window by which each data block is multiplied on the basis of the side information including the information regarding decoding the data block.

13. The filtering apparatus according to any one of claims 9 to 12, wherein said transformation means acquires the output data stream by making the matrixing on each data block of the input data stream in accordance with the following expression,

$$y = C_N^{IV} x$$

where x is a column vector of one data block contained in the input data stream, y is a column vector of output data

block corresponding to x, and C^{IV}_N is a DCT-IV transformation matrix represented by the following expression,

$$\left[C_N^{IV}\right]_{m,n} = \cos\left[\frac{\left(m + \frac{1}{2}\right)\left(n + \frac{1}{2}\right)\pi}{N}\right], 0 \le m, n \le N - 1$$

where N is the number of data contained in x.

14. A filtering apparatus for decoding a digital signal from the frequency domain to the time domain, comprising:

transformation means for multiplying an input data stream and a transformation matrix that is decomposed into a sparse matrix from a sub-band synthesis transformation matrix for making the sub-band synthesis of said input data stream composed of a plurality of data blocks and has a smaller size than said sub-band synthesis transformation matrix to acquire an output data stream composed of a plurality of data blocks;

memory means for storing said calculated data blocks;

memory control means for shifting each data block stored in said memory means by one data block, every time each data block of said output data stream is calculated, and storing the calculated data block in said memory means; and

digital signal output means for outputting the digital signal in the time domain on the basis of the data stored in said memory means.

15. The filtering apparatus according to claim 14, wherein

said transformation means makes the DCT (Discrete Cosine Transform)-IV transformation process for each data block of the input data stream, and

said digital signal output means further comprises:

multiplication means for folding back and expanding the predetermined data of the data block stored in said memory means and multiplying the expanded data by a predetermined window to acquire a data stream composed of a plurality of data blocks; and

addition means for adding the data contained in the data stream that are calculated by said multiplication means at a predetermined period.

16. The filtering apparatus according to claim 14 or 15, wherein said transformation means acquires the output data stream making the matrixing on each data block of the input data stream in accordance with the following expression,

$$y = C_N^{II} x$$

where x is a column vector of one data block contained in the input data stream, y is a column vector of output data block corresponding to x, and C^{II}_N is a DCT-II transformation matrix represented by the following expression,

$$\left[C_N^{II}\right]_{m,n} = \cos\left[\frac{m(2n+1)\pi}{2N}\right], \ 0 \le m, n \le N-1$$

where N is the number of data contained in x.